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LITERATURE REVIEW

Is acupuncture an effective treatment to improve range of movement and pain in frozen shoulder contracture syndrome? A narrative review

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Abstract

Frozen shoulder contracture syndrome (FSCS) is a common shoulder complaint that is characterized by significant pain and stiffness. It has major socioeconomic consequences because it primarily affects a working-age population. Conservative treatment is recommended in the first instance, but controversy remains over which treatments are superior. Alongside this, there is increasing utilization of acupuncture treatment for musculoskeletal problems in the National Health Service. However, there are currently no published guidelines or reviews regarding the use of acupuncture for FSCS. The overarching aim of this research was to undertake an extended literature review and synthesize the available evidence. A comprehensive search of the relevant electronic databases was carried out using key search terms. The evidence sourced was then scrutinized against established inclusion and exclusion criteria. Ten studies met the inclusion criteria. Pain and range of movement were the most common outcomes investigated. Overall, the results identified positive outcomes for treating FSCS with various prescriptions of acupuncture treatment. Stomach 38, and Large Intestine 15 and Triple Energizer 14 (i.e. "the eyes of the shoulder") are the most popular points referred to in the literature. Various acupuncture techniques can be utilized to improve stiffness and pain in FSCS. The use of distal points may be a logical starting point, and the earlier the patient is treated after the onset of symptoms, the greater the effects are likely to be. Generally, acupuncture is a safe modality with comparable results to interferential treatment, corticosteroid injection and electroacupuncture, and superior results to physiotherapy, exercises and no treatment. Future research is needed in order to identify further subgroups of patients with FSCS who may respond better to acupuncture.

Keywords: acupuncture, frozen shoulder contracture syndrome, pain, range of movement, stiffness.

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Introduction

The incidence of shoulder complaints has been reported to be as high as 29.3 patients per 1000 annually consulting a general practitioner (GP) (Greving *et al.* 2012), and the incidence of

frozen shoulder contracture syndrome (FSCS) in the general population ranges from 0.75–5.00% (Neviaser & Hannafin 2010; Bunker 2011). The variability in incidence rates has been attributed to a lack of standardized diagnostic criteria for epidemiological analysis, and the number of patients not seeking initial medical attention because of the vague and insidious onset of the condition (Bunker 2011; Hsu *et al.* 2011; Lewis 2014).

Codman (1934) described frozen shoulder for the first time as a condition that involves: a slow onset; a typically insidious onset (although trauma or strain might be predisposing factors); pain near the deltoid insertion; inability to sleep on the affected side; incomplete shoulder elevation; external rotation; and normal radiographic findings (except the possibility of bone atrophy). Neviaser (1945) suggested that the term "adhesive capsulitis" was superior since it described the capsule being adhered to the humeral head. However, subsequent studies have demonstrated thickening and contracture of the glenohumeral joint capsule in frozen shoulder without adhesions to the humerus (Wiley 1991; Uitvlugt *et al.* 1993; Bunker & Anthony 1995). It is for these reasons that Lewis (2014) proposed that this term be abandoned in favour of FSCS since solely using the term "frozen shoulder" suggests that the shoulder will eventually "thaw" without the need for treatment. Additionally, the use of "contracture of the shoulder" alone, as suggested by Bunker (2009), does not reflect the severe pain of the condition.

The syndrome can be further diagnosed as primary FSCS (i.e. related to immunological, biochemical or hormonal imbalances) and secondary FSCS (i.e. known causes of stiffness and immobility from shoulder surgery or trauma) (Hsu *et al.* 2011). Several risk factors have been associated with developing FSCS. Individuals with type I and II diabetes have up to a 20% higher risk of developing the condition (Pal *et al.* 1986; Bunker & Anthony 1995; Balci *et al.* 1999; Milgrom *et al.* 2008; Tighe & Oakley 2008; Li *et al.* 2014). Thyroid disease is also a risk factor (Cakir *et al.* 2003; Milgrom *et al.* 2008). Moderate evidence exists to suggest that FSCS is more prevalent in people aged between 40 and 65 years, females, and individuals with previous FSCS in the contralateral arm (Kelley *et al.* 2009).

Frozen shoulder contracture syndrome is classified into three or four stages: pre-adhesive; frozen/pain; freezing/stiff; and a thawing or recovery phase (Neviaser & Neviaser 1987; Favejee *et al.* 2011; Lewis 2014). The first and second stages are associated with diffuse, constant lateral shoulder pain, which is often worse at night when all shoulder movements cause pain. The result is significant disability for the individual. In the second phase, stiffness with decreased range of movement (ROM) predominates, with pain still present at the extremes of movement. Compromised shoulder mobility impacts upon hand placement, and therefore, negatively affects the performance of activities of daily living (Green *et al.* 2005). In the third phase, pain gradually subsides and movement increases, but exacerbations of pain still occur with excessive activity or minor trauma (Anton 1993). The exact aetiology of FSCS remains debated (Brue *et al.* 2007; Loveday *et al.* 2009).

On average, the symptoms of FSCS last for 30.1 months (Lewis 2014). However, Shaffer *et al.* (1992) found that 50% of patients with FSCS still suffered from pain and/or stiffness 7 years after its onset, and in another long-term study, Hand *et al.* (2008) reported that 41% of patients had ongoing symptoms at 4.4 years. These figures clearly indicate the devastating and lengthy impact of FSCS.

In the first instance, a conservative approach to treatment is adopted because of the potential for a natural resolution of the condition (Chambler & Carr 2003). Financial implications also play a role: a course of physiotherapy for FSCS has been estimated to cost £98.75–£126.75, as compared to manipulation under anaesthetic at £1446 and capsular release at £2204 (Maund *et al.* 2012). Therefore, physiotherapy is seen as the most cost-effective option, and is widely accepted as a first line of treatment in the management of FSCS (Hsu *et al.* 2011).

The Chartered Society of Physiotherapy endorsed an evidence-based review by Hanchard *et al.* (2011b) of the development of

clinical guidelines for the diagnosis, assessment and physiotherapy management of FSCS. No firm conclusions regarding management were reported, and no acupuncture studies were included because of the poor methodological quality of the one study identified in the review, which highlights the need for further research.

However, a questionnaire survey of physiotherapists by Hanchard *et al.* (2011a) found that 68% of respondents said that they might use or recommend acupuncture for pain-predominant FSCS, and 10% would use it in the stiffness-predominant FSCS phase, indicating that clinically based evidence suggests that acupuncture may be the therapy of choice for pain management. However, there are no national guidelines or review studies confirming the pain-relieving properties of acupuncture in FSCS. An extended literature review of the available evidence base on acupuncture for FSCS would help to inform clinicians further regarding its clinical effectiveness for pain and/or stiffness treatment, potentially improving patient outcomes and their experience of treatment.

Materials and methods

Literature search

A literature search was undertaken from the beginning of November 2014 to the end of April 2015. The following online databases were searched for available evidence: AMED (the Allied and Complementary Medicine Database); CINAHL (the Cumulative Index to Nursing and Allied Health Literature); MEDLINE (the Medical Literature Analysis and Retrieval System Online); Scopus; and Web of Science. Key terms were utilized during the search process: ("péri-arthrite scapula-humérale" OR "frozen shoulder" OR "adhesive capsulitis" OR "periarthritis of the shoulder" OR "50 year old shoulder" OR "contracted shoulder" OR "frozen shoulder contracture syndrome") AND (acupunctur* OR electroacupunctur*, OR "dry needl*" OR acupressure OR acupoint). A separate search of the Cochrane Database of Systematic Reviews, the AACP journal, relevant textbooks and specialist interest websites was also undertaken, and relevant articles were retrieved to make sure that no data had been omitted and to minimize publication bias.

The aim of this study was to undertake a narrative review of the current acupuncture evidence base, including Western medical acupuncture (WMA), traditional Chinese medicine (TCM) and electroacupuncture (EA) treatment for FSCS, and its effects on pain and stiffness. The secondary aims were to establish the current best evidence regarding the utility of acupuncture for FSCS, and to attempt to inform future management of patients with FSCS.

Inclusion criteria

Only publications from 2000 onwards were considered so as to ensure the inclusion of more recent evidence with potentially more robust methodologies. Any stage of FSCS was considered because, currently, little if anything is known about the effects of acupuncture at different stages of the disease, and exclusion would have significantly reduced the number of available trials. Studies were included if these utilized approaches that were pragmatic to usual care in the UK, such as: EA, trigger-point (TP) techniques and TCM. Studies were included if these utilized one outcome measure looking at pain, ROM or function in an attempt to address the primary aim of the present review.

Exclusion criteria

Articles were excluded if these were not written in English, utilized non-needling TCM techniques (e.g. cupping, tuina, moxibustion and auricular acupuncture), did not state how FSCS was diagnosed and were published prior to January 2000. The flowchart in Fig. 1 outlines the search process.

Literature review

The emerging themes have been coded from each article. The narrative synthesis that follows will present these findings in an attempt to answer the aims of the review in an open and honest way. The emergent themes include: point selection; the number of needles employed; the

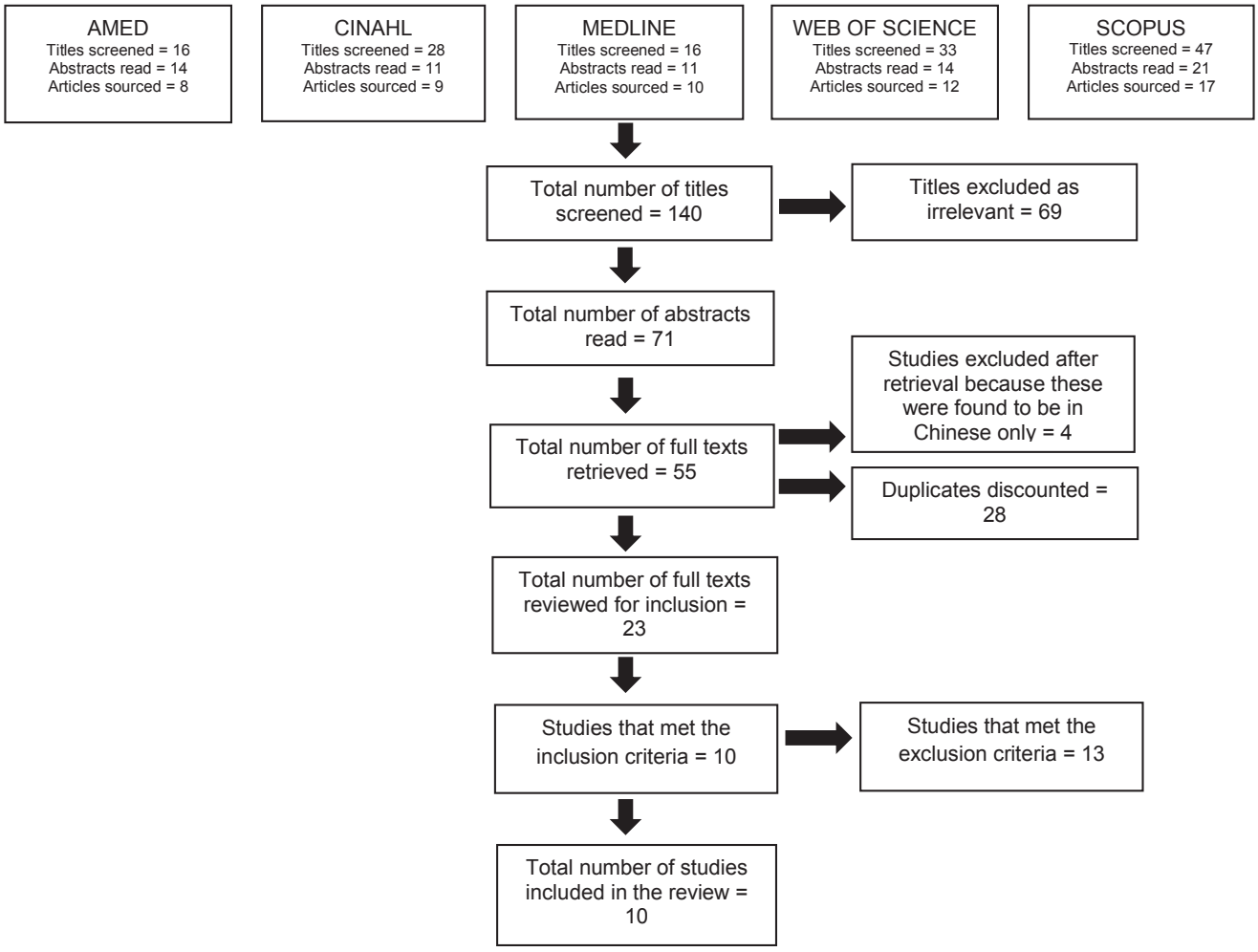

Figure 1. Search results.

side of treatment; dosage; stimulation; EA; and symptom duration. The results are presented in Table 1.

The trials included in the present review utilized various combinations of points (see Table 2). The advantage of using a local point over a distal point could be the local analgesic effects brought about in the target area by needle penetration, causing microtrauma and a local anti-inflammatory effect (Leung 2012). The insertion of a needle always represents intervention or injury, and therefore, the therapist must carefully consider every point, and be able to justify its use (Hempen & Chow 2005). Single-point acupuncture based on current evidence can be beneficial, and is advantageous to patients because it is more comfortable, meaning that more-frequent treatments can be carried out.

The sole use of distal points was more commonly found in the present review. The main advantage of using distal points or contralateral upper limb points is that more-comfortable exercising of the affected upper limb is possible during treatment because of the analgesic effects provided, as shown in a previous trial (Wang *et al.* 1990). In total, three studies from the review utilized shoulder exercises during the acupuncture treatment, and all of these trials involved only distal points (Sun *et al.* 2001; Wei 2008; Longbottom & Green 2009). No conclusions from the present review can currently be made as to whether exercising during acupuncture is more effective compared to not exercising, and there is no further literature to confirm or refute this.

Contralateral needling has the advantage of allowing treatments still to take place if local acupoints are too tender to needle, and has been advocated by various acupuncture books as a method of regulating the yin–yang balance

Table 1. Results of the literature review: (RCT) randomized controlled trial; (EA) electroacupuncture; (LI) Large Intestine; (TrP) trigger point; (ST) Stomach; (IT) interferential therapy; (HBEP) home-based exercise programme; (CMA) Constant–Murley assessment; (VAS) visual analogue scale; (TE) Triple Energizer; (SF-MPQ) short-form McGill Pain Questionnaire; (JOA) Japanese Orthopaedic Association shoulder scoring system; (ROM) range of movement; (UB) Urinary Bladder; (GB) Gall Bladder; (SI) Small Intestine; and (SJ) San Jiao

Reference	Study design	Participants	Key findings
Cheing *et al.* (2008)	Double-blinded RCT: (a) EA – LI15, one TrP + electrical current (2–100 Hz, 100–400 μs pulse width) ST38 simulated every 10 min, total time 20 min (b) IT – 80–120 Hz, four suction electrodes, stimulated just below patient's threshold (a + b) Both included a HBEP, set of shoulder mobilizations 5 × day (instructed to continue for 6 months) (c) control (no treatment)	(a) $n = 25$ (b) $n = 24$ (c) $n = 25$ At final analysis, $n = 70$ (a) 10 sessions over 4 weeks, 2–3 × week (b) 10 sessions over 4 weeks, 2–3 × week (c) 4 weeks (waiting list) Outcome measures: CMA and VAS	EA mean improvement at 4 weeks: CMA = 31.5% ($P < 0.001$), VAS = 46.5% ($P < 0.001$) IT mean improvement at 4 weeks: CMA = 42.2% ($P < 0.001$), VAS = 48.6% ($P < 0.001$) Control mean improvement at 4 weeks: CMA = 6.6% ($P = 0.107$), VAS = 1.3% ($P = 0.510$) Results maintained at 6 months No statistical difference between IT and AP
Fan *et al.* (2013)	Single-blinded RCT: (a) Ah-Shi points × 2, Jianquian (Extra), LI15, TE14 – puncture two Ah-Shi points perpendicularly then obliquely and remove needle (Hegu needling technique), then puncture three shoulder acupoints perpendicularly and retain needles for 20 min (b) Same points as above, puncture two Ah-Shi points and three shoulder points perpendicularly, retain needles for 20 min	(a) $n = 30$ (b) $n = 30$ Outcome measures before and immediately after treatment in both groups: SF-MPQ (severe pain/cramp pain/dull pain) and JOA	(a) Statistically significant differences in SF-MPQ scores after treatment ($P < 0.01$ or $P < 0.05$) (b) Statistically significant difference in severe pain only after treatment Between-group statistically significant difference in JOA score ($P < 0.01$ or $P < 0.05$), indicating a better effect in the treatment group than in the control group
Lin *et al.* (2005)	(1) Control – baseline measurement (no treatment) (2) Sham acupuncture – two non-acupoints in lower limb, connected to electrical constant current (0.5 MA, 1 ms square pulse, maximal tolerable intensity, 2 Hz × 20 min) (3) True acupuncture of ST38 towards UB57 and same electrical current as sham × 20 min Single session for all three treatments, order of treatments not varied	Total $n = 14$ Outcome measure: active ROM (scapular plane elevation) using video-based stereophotogrammetry Three trials of ROM for each treatment condition	Mean scapular plane ROM: (1–2) 102.91–103.9° – no significant difference (2–3) 103.9–111.25° – mean improvement = 7.35°, range = 1.49–24.61° Control (true acupuncture) – mean improvement = 8.34° True acupuncture resulted in significantly greater ROM compared to control and sham treatments ($P < 0.05$)
Longbottom & Green (2009)	Single-system research design ABAB research design: ABAB (patients 1, 2 and 3) BABA (patient 4) Phase A: exercise – shoulder exercise programme, advice and management, completed HBEP × 2 days, attended clinic on four occasions over 10 days Phase B: acupuncture – four sessions over 10 days, ST38 same side for 30 min, stimulated every 10 min Total of 20 treatments over 50 days	Total $n = 4$ Outcome measures at baseline and end of trial: Shoulder Pain and Disability Index, and active ROM using fluid goniometer before the trial and after the end of each phase	Patient 1: pain score and disability scores decreased from 72 to 38 and 71 to 57, respectively Patient 2: pain score decreased from 69 to 27, and disability score increased from 53 to 61 Patient 3: pain score increased from 86 to 100, and disability score decreased from 82 to 65 Patient 4: pain score and disability scores increased from 69 to 80 and 60 to 65, respectively

Reference	Study design	Participants	Key findings
Ma *et al.* (2006)	RCT Empirical study based on proactive quasi-experimental design (a) Control (physiotherapy only) (b) Acupuncture only (LI15, GB20, LI4, GB34 and TE14) (c) Acupuncture and physiotherapy Acupuncture: 4 weeks (2 × a week, 15 min per visit) Physiotherapy: 4 weeks (5 × a week), hot pack, short wave, joint mobilization, active shoulder exercises, 25–35 min	(a) $n = 30$ (b) $n = 30$ (c) $n = 15$ Outcome measures before treatment, and at the end of weeks 2 and 4: ROM (active and passive), Numerical Pain Rating Scale and 36-Item Short Form Health Survey	Acupuncture more effective at reducing pain Physiotherapy better at increasing ROM At 4 weeks, (b) and (c) produced statistically significant improvements in static pain ($P < 0.05$), dynamic pain ($P < 0.05$), flexion ($P < 0.05$), and active ROM and external rotation ($P < 0.05$)
Sun *et al.* (2001)	Double-blinded RCT (a) Physiotherapist-led group exercise programme (b) Exercise and acupuncture Group exercise: 30 min, 2 × a week for 6 weeks and home exercises [same for (a) & (b)] Acupuncture: 2 × a week for 6 weeks at Zhongping (Extra) on contralateral side, 20 min with three, 1-min needle manipulations during treatment period, patient also completed functional exercises during treatment period	(a) $n = 22$ (b) $n = 13$ Outcome measures before treatment, and at weeks 6 and 20: CMA and mean intake of analgesia	At 6 weeks: (a) 39.8% improvement in shoulder function (b) 76.4% improvement in shoulder function Both results sustained at 20 weeks At 6 and 20 weeks, (b) statistically significantly better than (a) ($P = 0.025$ and 0.048, respectively) Similar analgesic reductions for (a) and (b)
Taş-Cebe & Cummings (2013)	Single-blinded RCT (a) HBEP (b) Corticosteroid injection and HBEP (c) Acupuncture and HBEP HBEP: taught specific exercises by a physiotherapist and given exercise sheet 2 × a day for 6 weeks within pain-free range Corticosteroid injection: intra-articular glenohumeral injection (80 mg Depo-Medrol and 20 mL 0.5% Marcaine) Acupuncture: 1 × a week for 6 weeks (LI15, TE14, LI14, SI11, SI12, SI14, LI4, ST38) × 30 min	(a) $n = 5$ (b) $n = 8$ (c) $n = 7$ Outcome measures at baseline and after treatment: pain at rest and on movement (VAS), ROM (goniometer) and Oxford Shoulder Score	(b) and (c) more beneficial than exercise alone for short-term pain relief, movement an functional improvements (b) better for pain at rest (c) better for pain on movement No statistically significant differences between groups
Wei (2008)	Case-series from outpatient department Acupuncture: ST38 towards UB57 and GB34 on contralateral side, and LI4 on affected side Reinforcement – reducing manipulation used Alternation between GB34 and ST38 (Dao Ma method) Patients moved affected shoulder while needles were manipulated Needles manipulated every 3 min for 15 min Treatment every day × 5 = one course Second course for those with unsatisfactory results Functional exercises every day at home	Cure = no pain, no movement restriction Marked effect = no shoulder pain except occasionally with weather changes, no movement restriction Effective = pain in shoulder relieved, but worse with weather changes, slight restriction of movement Failure = pain in shoulder did not change markedly, movement still restricted	Cure: $n = 23$ Marked effect: $n = 15$ Effective: $n = 7$ Failure: $n = 5$ Effectiveness rate = 90%

Wu & Pang (2000)	Case series of 100 patients Acupuncture: SI9 and SJ5 on affected side Manipulation involving twisting and twirling (reinforcing–reducing method) Feeling of soreness, numbness and distension = De Qi 30 min daily Mild cases – six sessions Heavy cases – 10–15 sessions	Cured = patient could lift arm freely and pain disappeared Improved = patient could lift arm freely, but pain still present Ineffective = no changes found after treatment	Cured: $n = 87$ (six to 15 sessions, duration of symptoms 15–60 days) Cured: $n = 10$ (10–15 sessions, duration of symptoms 61–100 days) Improved: $n = 2$ (10–15 sessions, duration of symptoms 61–100 days) Cure rate = 97% Improved = 2% Ineffective = 1%
Wu *et al.* (2008)	Some 336 cases randomly divided into treatment and control groups Treatment: LI15 towards Jianqian (Extra), lifting and thrusting technique, needles connected to EA continuous wave, mild stimulation × 20 min, followed by manipulation: hand behind head, hand behind back, arm across body Control: same acupuncture as treatment group, but no manipulation Daily treatments × 5 over 3-day period, then second course	VAS: (0) no pain = 0; (1–4) mild = 1; (4–7) moderate = 2; and (> 7) severe = 3 ROM: abduction: (3) < 30°; (2) 30–90°; (1) 90–120°; and (0) > 120° Lateral rotation: (3) < 0°; (2) 0–20°; and (1) > 20° Touching neck with hand: disability = 3; difficulty = 2; some difficulty = 1; and no problem = 0 Touching spine with hand: disability = 3; sacrum 1 = 2; thoracic 12 = 1; and > thoracic 12 = 0 VAS and shoulder scores combined Infrared imaging before and after treatment	Cure: > 90% Marked effect = 70–90% Effect = 30–70% No effect < 30% Treatment group/control: cure = 82/29 marked effect = 56/53 effect = 20/53 no effect = 10/33 Total effective rate: treatment = 94.1% control = 80.4% Statistically significant difference between groups ($P < 0.05$) in favour of treatment group Temperature change: treatment increase of 2.52 °C control increase of 0.8 °C ($P < 0.05$)

Table 2. Frequency of the acupuncture points utilized across the studies: (LI) Large Intestine; (TE) Triple Energizer; (GB) Gall Bladder; (SI) Small Intestine; (ST) Stomach; and (SJ) San Jiao

	Acupuncture points														
	Local									Distal					Trigger
Reference	LI15	TE14	Jianquian	GB20	LI14	SI11	SI12	SI14	SI19	ST38	LI14	GB34	Zhongping	SJ5	(Ah-Shi) point
Cheing *et al.* (2008)										✓					✓*
Fan *et al.* (2013)	✓	✓	✓												✓*
Lin *et al.* (2005)										✓*					
Longbottom & Green (2009)										✓					
Ma *et al.* (2006)	✓	✓		✓	✓							✓			
Sun *et al.* (2001)													✓		
Taş-Cebe & Cummings (2013)	✓	✓			✓	✓	✓	✓		✓	✓				
Wei (2008)										✓	✓	✓			
Wu & Pang (2000)									✓					✓	✓
Wu *et al.* (2008)	✓*														

*Studies that included electrical stimulation.

(Woo *et al.* 2006). Studies have shown the positive effects of contralateral acupuncture on pain and blood flow in patients who have suffered from strokes, and in rat models (Moon *et al.* 2000; Park *et al.* 2000; Seo *et al.* 2001; Kim *et al.* 2010). In a study of contralateral EA utilizing blind-spot perimetry length as an outcome in normal subjects, Woo *et al.* (2006) concluded that contralateral-side treatment had a better effect than ipsilateral-side treatment on brain function. This supports the positive findings found in the present review, but further research is required to validate this effect and to compare the superiority of contralateral versus ipsilateral treatment in patients with pathology.

Longbottom & Green (2009) published the only other study that investigated treatment involving a singular distal lower-limb point (ST38) on the side affected by FSCS combined with shoulder movements. Their study combined phases of acupuncture followed by exercises in different orders in just four patients. They had varying results, with two patients improving their pain scores over the 50-day trial period, but two having worse pain scores. At the end of the trial, two participants had better function and two had worse functional outcomes. These authors used the Shoulder Pain and Disability Index as an outcome measure; this is recommended for use in FSCS, and has been found to be valid and reliable (Roller *et al.* 2013). Longbottom & Green (2009) could explain some of their poor findings: one patient had unstable baseline scores; on reflection, another participant was believed to be suffering from a more-complex pathology since post-trial X-rays revealed osteoporosis of the humeral head. A third patient was very anxious about the acupuncture treatment, and two participants could not tolerate strong De Qi, all of which could have had negative effects on the results. This study potentially highlights the need to select patients very carefully in order to improve the chances of successful treatment with acupuncture in FSCS. Anxiety around needling, more-complex pathologies and an inability to tolerate strong De Qi sensation may negatively affect acupuncture outcomes (Chiang 1974; Ceniceros & Brown 1998; Sun *et al.* 2001), and this may have been the case in Longbottom & Green's (2009) trial.

Four studies employed a combination of local and distal points, all on the side affected by FSCS. Using one local and one distal point in a case series of 100 patients, Wu & Pang (2000) found a 97% cure rate, while 2% of the participants improved and 1% did not. These are very positive results, but the lack of a standardized outcome measure is a limitation to the findings. Cheing *et al.* (2008) utilized a local point, a distal point and one local trigger point, and electrically stimulated the local and trigger points. They found improvements in functional and pain scores 4 weeks after treatment: the Constant–Murley assessment (CMA) score improved by 31.5%, and a visual analogue scale (VAS) score decreased by 46.5%. This result was statistically superior to no treatment, but had a similar effect to interferential treatment. Therefore, based on this study's findings, both acupuncture and interferential therapy can be recommended over no treatment in FSCS to improve function.

Ma *et al.* (2006) selected three local and two distal points. They compared physiotherapy to acupuncture and physiotherapy plus acupuncture. These authors found that acupuncture was more effective at reducing pain, and physiotherapy was more successful at increasing ROM; therefore, a combination of the two treatments was the most effective regime. Acupuncture alone did not produce a significant improvement in ROM until the end of the fourth week, but physiotherapy increased ROM significantly after 2 weeks. However, the physiotherapy group did receive a larger amount of treatment. Therefore, the authors could not be certain that the positive effects were not the result of either a greater volume of treatment being received, or more of a placebo effect from increased therapist contact time.

Taş-Cebe & Cummings (2013) utilized six local and two distal points. They compared a home-based exercise programme (HBEP), injection plus HBEP and acupuncture plus HBEP. These authors found that a corticosteroid injection plus HBEP was better for pain relief at rest, and acupuncture plus HBEP was more beneficial for pain on movement. Corticosteroid

injection and acupuncture were more beneficial than HBEP alone for short-term pain relief, movement and function. However, there were no statistically significant differences between the groups, which Taş-Cebe & Cummings (2013) concluded was purely caused by the strict inclusion criteria, and their inability to recruit the required sample size. This negatively affects the ability to generalize these findings to the wider population. The cost of the corticosteroid itself is low, but there will be high costs generated from a consultant appointment to carry out the injection at a clinic. Based on this study, that cost would need to be comparable to six treatment sessions of acupuncture.

In a study of patients being treated with acupuncture for a variety of musculoskeletal problems, Lindall (1999) found that the average cost of an acupuncture course for FSCS was £184 (for four sessions), which contrasted with the expected referral-on cost, specifically to orthopaedics, of £481. Although only four sessions of acupuncture were given, an extra two appointments would still cost less than seeing a consultant.

The major disadvantage of steroid injection is that the treatment effects tend to reduce at 6 weeks (Bal *et al.* 2008; Kelley *et al.* 2009), as compared to acupuncture, which usually has a cumulative effect (Li *et al.* 2014). This study only had a 6-week follow-up, and it would be interesting to see whether a longer follow-up would have revealed any more significant differences between the groups. The benefit of acupuncture treatment is that it can be continued past 6 weeks. If so, as the results of Taş-Cebe & Cummings (2013) suggest, extended treatment could provide analgesia on movement. This would potentially allow patients to tolerate physiotherapy or exercises more effectively, allowing them to achieve more functional ROM gains. Cheing *et al.* (2008) had the longest follow-up period of any study in the present review, i.e. 6 months. They found that the positive effects of acupuncture at improving function and decreasing pain were maintained at 6 months' follow-up.

The argument as to whether acupuncture is more effective than steroid treatment has not been answered in the present review. However, the findings suggest that steroid injection may be of more benefit for resting or night pain in the initial inflammatory phase, whereas in the painful and stiff phase, acupuncture may be more helpful. However, further research is required to validate this finding.

The total number of acupuncture points employed varied between one and eight in the studies reviewed. The average number of points used for local treatments was three: one or two for distal points, and four or five for combined treatments. Therefore, distal point use alone is more likely to result in fewer total needles, and combining points will generally involve more needles. Other studies confirm that increasing the number of needles does not have a positive influence on outcomes (Taechaarpornkul *et al.* 2009; Ceccherelli *et al.* 2010). If fewer points can bring about similar effects, this would be advantageous and could be utilized as a clinical starting point. If a patient fails to respond, the addition of further points could be considered, with the possibility of combining local and distal points.

Dosage

All three studies that utilized electrical stimulation of the needles involved a treatment time of 20 min (Lin *et al.* 2005; Cheing *et al.* 2008; Wu *et al.* 2008). A study by Jiang *et al.* (2014) concluded that the analgesic effect of transcutaneous electric acupoint stimulation, as measured by functional magnetic resonance imaging (fMRI), started after 20 min of treatment, and was maintained until after-treatment states. This highlights the reasoning behind 20-min treatment times being selected by many of the studies included in the present review.

Wei (2008) used a shorter treatment time of 15 min, but in this study, the needles were stimulated manually every 3 min (more than any other study), which could have potentially increased the treatment strength and effect by creating a local response. Ma *et al.* (2006) utilized a shorter treatment time of 15 min, but provided no justification for why this duration was chosen.

The study by Longbottom & Green (2009) utilized a longer treatment time of 30 min. One reason for this could be the utilization of only one needle in an endeavour to increase the treatment dose. However, several other single-needle studies utilized shorter treatment times; for example, Sun *et al.* (2001), Lin *et al.* (2005) and Wu *et al.* (2008). Additionally, Taş-Cebe & Cummings (2013) utilized a 30-min treatment period, but had the largest number of points of all the studies included in the present review. There are no obvious trends or logical reasons in the data regarding the selection of treatment time, and no positive trends towards one duration having superiority over another.

Wu & Pang (2000) employed the largest volume of treatment time, reporting a total treatment time of 300–450 min over 6 consecutive days in mild cases, and 10–15 daily sessions in "heavy" cases. They described an excellent "cure rate" (i.e. full ROM and no pain) of 97%, but did not utilize any standardized outcome measures. Wu *et al.* (2008) also utilized daily acupuncture for 5 days before 3 days' break, and then daily again for another 5 days, equalling 10 treatments in total. This gave a total treatment time of 200 min and an efficacy rates of 80.4% and 94.1% in the acupuncture treatment and acupuncture plus manipulation groups, respectively. The other study to use five daily sessions (total treatment time = 75 min) was by Wei (2008). Although entailing a smaller total treatment time, the intensity was increased with frequent manual stimulation (every 3 min). Again, Wei (2008) reported a very favourable efficacy rate of 90%, perhaps suggesting that the intensity of the treatment is more important than the total treatment time. However, the author did state that a second course of the above treatment regime was given to those who needed it, consequently doubling the dose. Unfortunately, no breakdown of these figures was provided, so it is impossible to know how many patients received the smaller doses, which limits the ability to generalize the results of a short, intense course of treatment. On balance, the findings show favourable findings for intensive daily treatments.

Sun *et al.* (2001) administered a total of 240 min of acupuncture over 6 weeks in 12, twice-weekly sessions. This study found statistically better results for combining exercises and acupuncture than a physiotherapy-led exercise programme at 6 weeks, and this was also the most methodologically sound trial. Longbottom & Green (2009) also used a total acupuncture treatment time of 240 min, but this was over 50 days in eight, 30-min treatments. Their diminished findings could be a result of the treatments being carried out less frequently or its methodological flaws. Therefore, it is difficult to draw any firm conclusions regarding treatment frequency when comparing these two specific studies.

Cheing *et al.* (2008) also used more-frequent sessions, providing acupuncture two to three times a week over 4 weeks, giving a total treatment time of 200 min over 10 sessions. Their results were statistically superior to no treatment at 4 weeks and were maintained at 6 months, but were not superior to the same dosages of interferential treatment. As discussed previously, Taş-Cebe & Cummings (2013) utilized the highest number of needles (eight), but had a small amount of treatments (30 min once a week for a total of six sessions), bringing the total treatment time up to 180 min, which is comparable to the majority of the other studies. Their findings showed positive results, but these were not statistically significantly in favour of acupuncture or injection combined with a HBEP over a HBEP alone. They concluded that they needed a larger sample size to achieve statistically significant results, but based on the previous studies, it may be worth knowing the effect of increasing the frequency of acupuncture to twice a week over 6 weeks. This would be more comparable to the previously mentioned trials, which have more statistically positive findings (Sun *et al.* 2001; Cheing *et al.* 2008; Wu *et al.* 2008).

Ma *et al.* (2006) utilized 15 min of acupuncture twice a week over 4 weeks for a total of eight sessions (total treatment time = 120 min). They found that acupuncture was more effective for pain relief than physiotherapy up to 4 weeks, while physiotherapy was more beneficial for improving ROM. A combination of the two treatments was the most effective approach.

However, Ma *et al.* (2006) did compare a total treatment time of 120 min of acupuncture to a total physiotherapy treatment time of between 500 and 700 min. This makes it very difficult to conclude whether it is the treatment time or the individual treatments themselves that produce superior results. Despite this, the study does highlight how a short duration of acupuncture treatment (15 min) twice a week can provide effective pain relief in FSCS, again suggesting that the frequency of treatment may be a more important variable than individual treatment times.

Stimulation: De Qi and needling technique

Only one publication failed to mention whether De Qi sensation was initiated (Ma *et al.* 2006). All the other nine studies stated that De Qi was achieved at least once at the beginning of the treatment, highlighting the consensus that this is vitally important to obtaining a successful treatment (Chiang 1974; Ceniceros & Brown 1998; Sun *et al.* 2001). Many of the authors described needle sensation/De Qi being delivered at the maximal tolerable intensity (Lin *et al.* 2005; Cheing *et al.* 2008) or strong/marked De Qi (Wu & Pang 2000; Sun *et al.* 2001; Wei 2008; Longbottom & Green 2009). In contrast, Wu *et al.* (2008) only evoked a mild sensation with EA. Fan *et al.* (2013) and Taş-Cebe & Cummings (2013) described De Qi as being achieved, but gave no further details regarding the strength of the needling.

Longbottom & Green (2009) described agitating the needles in a clockwise direction every 10 min. Taş-Cebe & Cummings (2013) also reactivated the needles by twisting three times in 30 min. Sun *et al.* (2001), Cheing *et al.* (2008) and Wu *et al.* (2008) utilized lifting and thrusting techniques to stimulate the needles. Wei (2008) and Wu & Pang (2000) used a reinforcing reducing manipulation. Reinforcing techniques invigorate the body's resistance, and are generally slow, gentle and of short duration. Reducing techniques are adopted to eliminate pathogens, and are generally rapid, forceful and of long duration. Both techniques involve lifting, thrusting, twirling and rotating the needles (Gao *et al.* 2012).

Fan *et al.* (2013) compared Hegu and perpendicular needling of two Ah-Shi points to normal needling of both "eyes of the shoulder" [Large Intestine (LI) 15 and Triple Energizer (TE) 14] and Jianqian (an extraordinary point). Hegu needling involves inserting the same needle in multiple directions. This leads to a stronger needling sensation, which could reduce the number of points needed to achieve a similar effect, and Fan *et al.* (2013) found it to be statistically superior to perpendicular needling for pain relief and improving function in a single treatment session. This is the only study to compare different types of needling effects directly. It would be interesting to compare ROM changes resulting from solely employing Ah-Shi points around the shoulder versus normal needling, and versus normal needling combined with Ah-Shi points.

The trends in the research suggest that evoking the De Qi sensation is vital for positive treatment effects, and stronger stimulation is a more popular choice. The most common stimulation time reported in the studies is every 10 min. Sun *et al.* (2001) was the only publication that described the length of stimulation (1 min). None of the other studies described this in further detail, and therefore, no firm conclusions can currently be drawn.

Electroacupuncture

Electroacupuncture was employed in three of the trials included in the present review. Cheing *et al.* (2008) compared EA to interferential treatment and no treatment. Electroacupuncture had a statistically significant effect on improving functional (CMA) and pain scores (VAS) over no treatment ($P < 0.001$). This is a similar dose to that employed in other studies, as shown in a systematic review of chronic lower back pain by Lam *et al.* (2013).

In the present authors' experience, EA is usually reserved for chronic or severe cases. There is no indication of the severity of the symptoms in the Cheing *et al.* (2008) study. The average duration of onset varied from 1–24 months,

suggesting some chronicity of cases, but this variable was not independently studied and no further conclusions can be drawn regarding chronicity.

In a small study of 14 patients, Lin *et al.* (2005) compared no treatment to sham needling of two non-acupoints in the lower limb and true treatment of Stomach (ST) 38 punctured towards Urinary Bladder 57 in the lower limb. The sham and true treatments were subjected to the same electrical stimulation. Lin *et al.* (2005) found no significant difference in ROM after sham treatment, but reported an average improvement of 8.34° following true acupuncture treatment ($P < 0.05$). Patients with pain and stiffness symptoms of at least 1 month were recruited from an orthopaedic department. Their average age was 56 years, but again, the authors gave no indications regarding chronicity and did not state their reasoning for choosing EA. Their trial did not examine the effects on pain, which would be useful to know since this is the other main disabling symptom of FSCS. If the study were to be repeated, a fourth trial condition involving acupuncture of ST38 without electrical stimulation would be useful to discover if EA has a superior effect. However, the methodology of this study would need to be revised to vary the order of treatments and increase the numbers of subjects. This would be necessary in order to validate the beneficial and not just cumulative effects of true EA.

Wu *et al.* (2008) published the only other study of the use of EA on a single point. The main purpose of this research was to compare EA alone to EA in combination with manipulation, which was found to be superior. Nevertheless, the group receiving EA alone still had an effectiveness rate of 80.4% in comparison to 94.1% for the combined group.

Recent research by Jiang *et al.* (2014) compared the effects of high- and low-frequency (2–100 Hz) transcutaneous electrical acupoint stimulation (TEAS). They used fMRI on normal subjects, and concluded that, although the mechanisms of low- and high-frequency TEAS are distinct, these partially overlap. Consequently, the frequency of the electrical dose will elicit varying pain mechanisms, and therefore, could produce differing responses. There is no explanation of why certain, differing frequencies were chosen between the three studies included in the present review. However, comparing different electrical frequencies in the treatment of the same pathologies, and thereby, highlighting which is more effective, would be a useful area for future research.

Symptom duration

Only one trial investigated the individual effects of symptom duration on acupuncture response. In a case series of 100 patients with FSCS, Wu & Pang (2000) studied three groups with different durations of symptoms: (1) 15–40 days ($n = 50$); (2) 41–60 days ($n = 37$); and (3) 61–100 days ($n = 13$). They also varied the treatment volume delivered as necessary on the basis of disease severity. Mild cases received six sessions and "heavy" cases received 10–15 as one therapeutic course. Wu & Pang (2000) reported an overall cure rate of 97% and an effectiveness rate of 99%. Analysing their results, the authors found that a symptom duration of between 15 and 60 days resulted in 87 cases being cured completely over six to 15 separate sessions (cure rate = 100%), and a disease duration of between 61 and 100 days resulted in 10 cases being cured over 10–15 separate sessions (two other cases improved, and treatment was not effective in one case). The overall rate of effectiveness for Wu & Pang's (2000) study was high, but a small trend in the results showed that a more-chronic symptom duration (61–100 days) leads to a slightly increased risk of a poorer outcome (83% cure rate versus 100%).

Currently, this study contributes to a weak evidence base that acupuncture is more effective at improving pain and ROM in cases of FSCS with a shorter symptom duration from the time of onset. Therefore, it may be that acupuncture in practice would be better utilized as an initial treatment, rather than a "go to" treatment if other methods have failed.

Limitations

The present review has several limitations. The first author (S.M.A.) carried out the initial search

for articles and subsequent reading of abstracts and studies single-handedly, meaning that some data may have been overlooked. The research paradigm and the authors' epistemological view should be considered when interpreting the findings. The authors' personal perspectives and preconceptions should be ignored. Any researcher bias will be acknowledged (Bushman & Wells 2001; Cohen & Crabtree 2008; Säljö 2009).

Only articles published in English were included, and therefore, further relevant research may have been omitted. Ten studies were retrieved for inclusion and synthesized, meaning that there was a combined total of 764 patients (range = 4–336). The large variation in the number of subjects between trials means that readers should interpret the conclusions drawn in the present review with caution, especially when these concern trials with a small sample size since this can limit overall effect sizes and general inferences, and create bias in the results seen.

Conclusions

Some conclusions can be drawn regarding the use of acupuncture for FSCS. However, these need to be viewed with some caution, primarily because of the heterogeneity, small volume and varying quality of the literature.

Overall, the findings from the present review indicate that acupuncture can improve pain and stiffness in patients with FSCS. Future research should aim to investigate its effect on other variables (e.g. disease severity and duration, and diabetes) in order to improve the clinical effectiveness and utility of acupuncture, and the overall management of patients with FSCS.

The use of single-point treatments can be effective at increasing function and decreasing pain in patients with FSCS, and has the advantage of fewer needles being utilized. This can make treatments more comfortable for patients, with fewer side effects, without negating the positive benefits. At present, ST38, LI15 and TE14 are the most popular acupoints utilized in the treatment of FSCS, but the clinical superiority of these points over others advocated in FSCS has not yet been established in the literature.

The use of distal needling in the lower limb has been shown to be an effective treatment. Choosing distal points is likely to result in fewer total needles being employed, and on average, utilizing both local and distal points will require more needles. Therefore, it may be logical to start clinical treatments with distal points alone, and then, if there are no positive results, add more local points. This has the additional advantage of providing a local segmental effect for pain relief.

The large range of points utilized in the studies included in the present review suggests that there is flexibility within point selection, and there may not be a one-size-fits-all approach to acupuncture treatment for FSCS. Same-side needling is more popular in the research, but contralateral acupuncture can also be effective. The latter approach has benefits such as needling away from painful areas that cannot tolerate treatment, and enabling the affected limb to be exercised at the same time.

Acupuncture is more useful for treating pain on movement, and therefore, could allow more-effective physiotherapy and exercise therapy to take place. In addition, needling may be more beneficial during the pain and stiffness phases of FSCS. Acupuncture may also be more effective in patients with FSCS who experience a shorter onset of symptoms, and therefore, it should be a priority treatment of choice in the early stages of the disease. It has some potential advantages over corticosteroid injection, which include costs and the duration of effect. However, acupuncture is no more beneficial than interferential treatment for treating FSCS, and therefore, patients could choose which treatment they would prefer.

Patient selection for acupuncture treatment is important, and issues around anxiety, more-complex pathologies masquerading as FSCS or the inability of patients to tolerate strong De Qi may all have a negative impact on treatment outcomes. The trends found in the present review suggest that the frequency of treatment (higher being more beneficial) is more important than the total number of treatments

or treatment times. No conclusions can be drawn regarding specific recommendations for preferable techniques to stimulate De Qi, but utilizing a strong sensation is the more-popular practice in the literature. Shorter treatment times can be made more intense by using more frequent needle stimulation, and have been shown to be equally effective compared to longer treatments. Hegu needling of Ah-Shi points is statistically more advantageous for improving function and decreasing pain than perpendicular needling.

Electroacupuncture can be utilized in FSCS as a successful treatment for stiffness after one individual session, and for pain and stiffness after a course of 10 treatments. Whether the different physiological effects produced by EA are superior to standard acupuncture has not been yet established, but investigating whether chronicity or disease severity are factors to consider would be a useful area for future research.

The present review has highlighted the effectiveness of acupuncture as a treatment for pain and mobility limitation in patients with FSCS. In addition, acupuncture has the benefit of low costs, and therefore, if it were utilized more readily and prior to surgical options, this could have positive effects on already stretched National Health Service budgets in the current economic climate.

The key messages of the present literature review are listed in Box 1.

Box 1. Key messages: (FSCS) frozen shoulder contracture syndrome

- Acupuncture can improve pain and stiffness in FSCS.
- The use of single-point treatment for FSCS can be effective, and therefore, fewer needles will be employed.
- Stomach 38, Large Intestine 15 and Triple Energizer 14 are the most popular points.
- Distal lower limb points have been shown to be effective and allow exercising of the upper limb at the same time.
- Acupuncture may be more beneficial for treating pain on movement, and therefore, be more effective than exercises.
- Acupuncture should be considered a priority treatment in the early stages of FSCS.
- An increased frequency of treatment appears to be more beneficial than the total number of treatments.
- Strong De Qi stimulation is a popular practice.

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Sophie Adam and D. E. Prescott biographies needed.

